authentication solution, it is also possible to utilize a smartcard within a ZTIC to protect private data from extraction and duplication.

For all this, the ZTIC hardware consists conceptually, at a minimum, of a processing unit, volatile and persistent memory, a small display and at least two control buttons (OK and Cancel). An optional smartcard reader is also available. The software is minimally configured with a complete TLS engine including all cryptographic algorithms required by today's SSL/TLS servers, an HTTP parser for analysing the data exchanged between client and server, plus custom system software implementing the USB mass storage device profile and the networking proxy for running on a PC. All this fits easily into the USB stick implementation.

The information flow is shown in Figure 1. The secure channel is opened between the (bank's) server and the ZTIC. The user communicates as usual with the server via a PC.

The result of any sensitive operation is shown on the small display of the ZTIC, requiring the user to accept or cancel the transaction. Even if there should be malicious software manipulating the flow in the PC, the user can cancel the transaction. What the user sees on the ZTIC display is identical to what the server sees, no matter what malicious intervention may have occurred. Hence, owing to the direct secure connection between ZTIC and server, the ZTIC essentially provides a window to the server.

ZTIC has been programmed such that no change is required in either the server software or the software running on the client's PC. It runs on all operating systems. The USB stick implementation adds only a minimal and quite acceptable delay to the transaction processing time.

Link:
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MeshLab: an Open-Source 3D Mesh Processing System

by Paolo Cignoni, Massimiliano Corsini and Guido Ranzuglia

MeshLab is a free and open-source general-purpose mesh processing system designed to assist in the management of not-so-small, unstructured 3D models that typically occur in the pipeline when processing 3D scanned data in the context of Cultural Heritage. MeshLab provides a set of tools for editing, cleaning, healing, inspecting, rendering and converting the resulting meshes.

The MeshLab system was developed by ISTI-CNR in the framework of the EPOCH Network of Excellence funded by the European Commission. EPOCH is a network of about one hundred European institutions collaboratively producing applications involving digital versions of Cultural Heritage material. One of the objectives of Epoch has been to provide a clear organizational and disciplinary framework to improve the quality and effectiveness of the use of information and communication technologies for cultural heritage.

Within this framework EPOCH has created a Common Infrastructure, ie a set of tools, people, institutions and procedures aimed at collaboratively producing applications involving digital versions of tangible cultural heritage objects represented in diverse types of memory institutions. MeshLab is a typical example of such a tool, designed to help the flow and adaptation of 3D data between different CH applications.

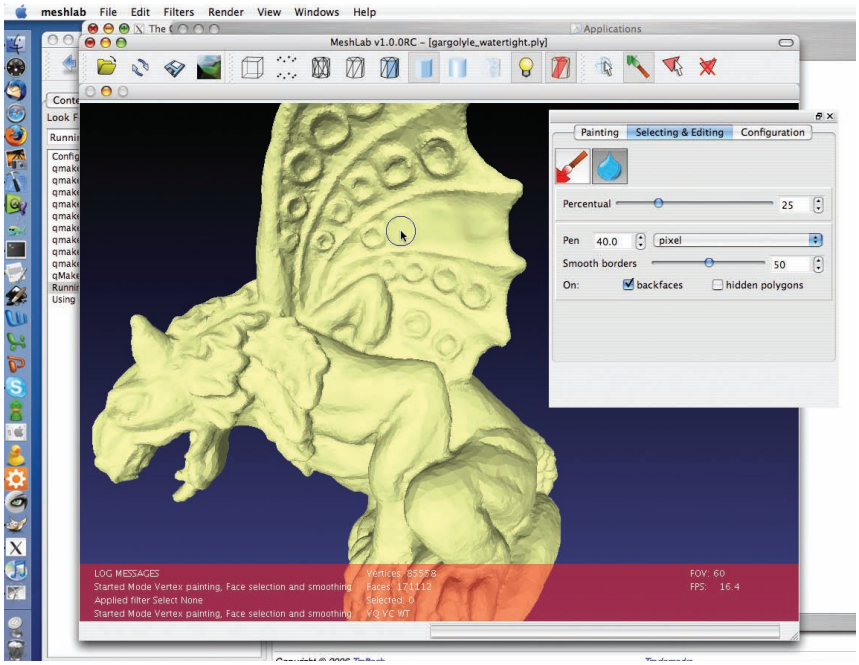
MeshLab was designed as a general 3D mesh processing tool with three primary objectives in mind:

- *Ease of use* - users without high 3D modeling skills should be able to use it (at least for the most basic functionalities)
- *CH/3D scanning oriented* - the system should focus on mesh processing tasks instead of mesh editing and design where a number of fierce competitors already crowd the software arena (such as notably Blender, 3DMax and Maya).
- Efficiency - the tool should be capable of managing the millions of primitives which often compose 3D scanning meshes.

MeshLab is thus an intuitive mesh viewer application, where a 3D object, stored in a variety of formats, can be loaded and interactively inspected in a easy way, by simply dragging and clicking on the mesh itself. MeshLab supports an ever growing variety of 3D formats (all the most common ones are supported) to accommodate the broadest set of users. Once a mesh is loaded, the user can work on it by mean of a large set of direct parametric filters that perform smoothing, re-meshing and simplifying tasks either automatically or by means of interactive tools. The figure shows an example of an interactive filter: when the user drags the mouse over the mesh, a local smoothing is performed in real time. In this case, the result is that the user is washing out some features of the object. This is a typical operation when processing data coming from 3D scanning, which often presents substantial amounts of noise.

It should be noted that in MeshLab no classical design-oriented features or typical CAD functionalities are provided: structured editing of complex scene graphs is not supported by design. Multiple meshes can be loaded together and separately or jointly processed following an approach based on a layers metaphor.

MeshLab currently provides many mesh processing functionalities. For



MeshLab, an open source mesh processing tool in action. User can interactively smooth the surface removing unwanted noisy features from a 3D scanned mesh.

reasons of space, we just present a short, incomplete, high-level list of MeshLab features. A large set of the functionalities of MeshLab cover the so called 'mesh cleaning' needs, offering tools to correct the geometric/topological imperfections that often affect 3D scanned data and 3D models in general. Typical examples are removal of duplicated, unreferenced vertices, null faces, small isolated components, coherent normal unification and face flipping, erasing of non-manifold faces and massive automatic filling of holes. Many mesh inspection tools are provided in MeshLab to analyze and assess in a intuitive, visual, and measurable way the quality and the correctness of the examined meshes.

With the most recent release, a set of tools have been added to MeshLab to implement the full 3D scanned data processing pipeline: from the raw sources obtained by the hardware acquisition devices to the final clean, ready-to-be-used 3D model. This processing pipeline includes a subsystem for the alignment of 3D meshes that allows to precisely register many different raw range maps and a set of three different algorithms for surface reconstruction that merge the multiple range maps obtained by 3D scanning devices into a single mesh.

The system has proved a greater success than expected. The first stable version was downloaded 30,000 times over a nine month period. The last version has been downloaded more than 5000 times in just the first three weeks. Currently there are thousands of users from all the world, coming from hundreds of universities and renowned commercial companies that have found MeshLab useful in contexts that often differ widely from the original one of Cultural Heritage.

Links:
http://meshlab.sourceforge.net
http://www.epoch-net.org

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Real-time Tracking of Sound Parameters in a Multimedia System

by Graziano Bertini, Gianfranco Lucia, Simone Lunardi and Massimo Magrini

Modern multimedia performances and presentations offer innovative methods for user interaction, in order to be more appealing to the audience. Following this trend and in collaboration with VIS S.r.l. (an SME in Rome), the Institute of Information Sciences and Technology (ISTI-CNR) has developed a system called Pandora, which controls real-time video effects applied to filmed or synthesized scenes by means of parameters extracted from sound signals. The system can be used both for artistic interactive multimedia performances and also for other non-artistic applications.

The evolution of electronic technology and the growing presence of computer science in the music field have greatly transformed ways of 'making music', involving various aspects from creation to production and performance, and leading to the appearance of new artistic forms. The audio functionalities are often closely intertwined with the world of graphics, video, performance, virtual reality and telecommunications, creating artistic and cultural multimedia products. This means that an efficient data-processing system will play an essential role in ensuring that all the operations planned during the conceptualization and design of a performance can be realized rapidly and smoothly, allowing the performance to take place in real time with a high level of interactivity.

Researchers of the ISTI computerART Lab and the DSP Audio team [1,2,3] have focused on developing systems that detect real-time features from body actions during interactive artistic multimedia performances. Two relevant exam-